

Particle injection through reconnection in the dayside magnetopause

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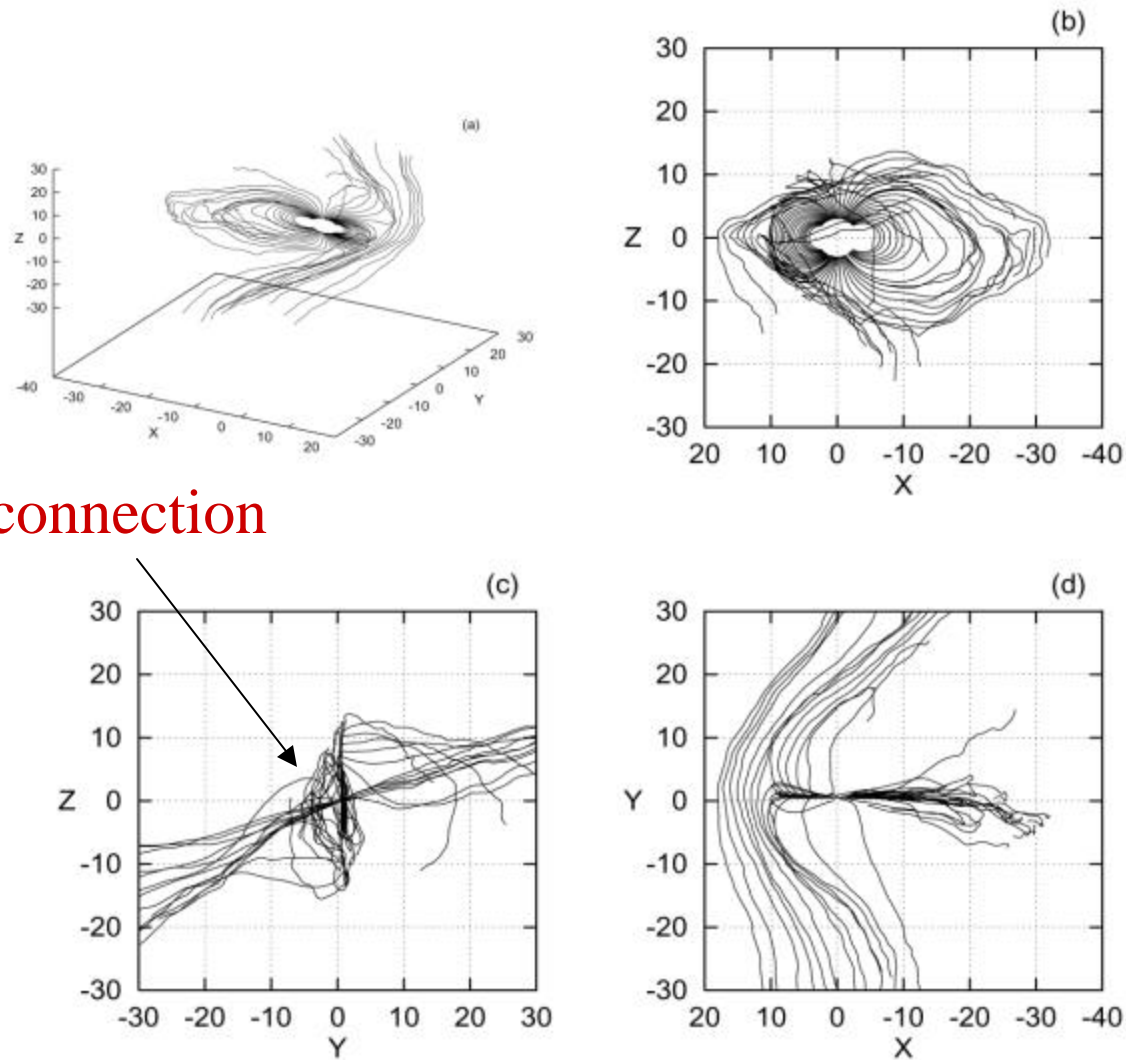
Particle injections at magnetopause

- **Reconnection (Sash) at the magnetopause**
IMF B_y component controls reconnection site (sash)
and facilitate particle injection, which has been
observed by Interball (*Stenuit et al., 2001; Popescu et al., 2001*)
- **Impulsive penetration**
Hot flow anomalies (HFAs) at the bow shock driven by
its interaction with IMF discontinuities cause particle
injections (*Sibeck et al., 1999, 2000, 2001*)

Global particle simulations with a dawnward IMF for studies of particle injections

- **Northward IMF** **vs** **Dawnward IMF**
- **Reconnection at northern dawnside and southern duskside**
- **Open magnetic fields** facilitate **particle injections**
- Null magnetic field regions (**reconnection grooves, sash**) extend tailward from the dayside magnetopause
- Particle injection through **reconnection grooves** in the tail, which is observed by Interball-Tail
- **Cluster-II observations** will provide essential information of structure and evolution of **reconnection grooves and associated particle injection** which will be compared with global particle simulation results

Magnetic field with **dawnward IMF**

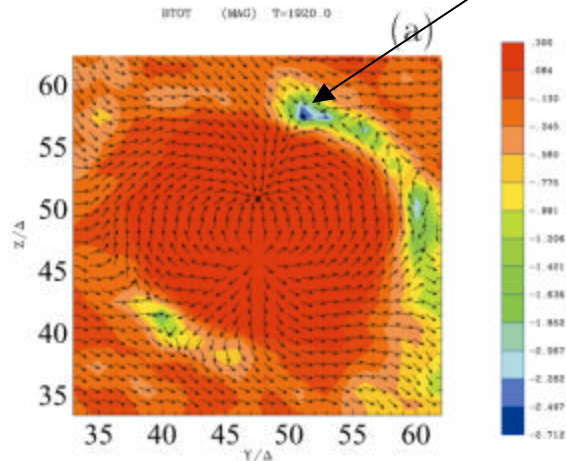


Reconnection

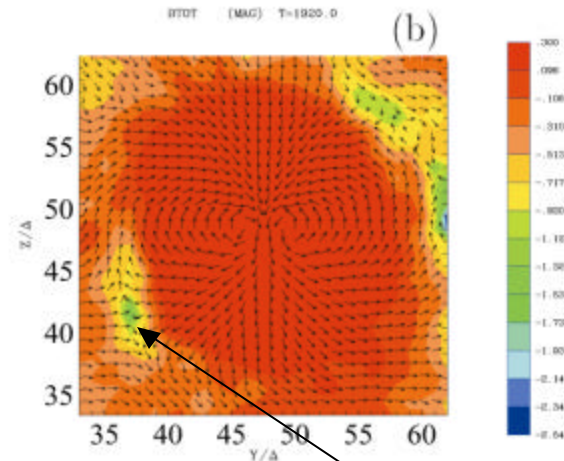
Nishikawa, GRL 1998

Dusk-dawn cross-sectional slices

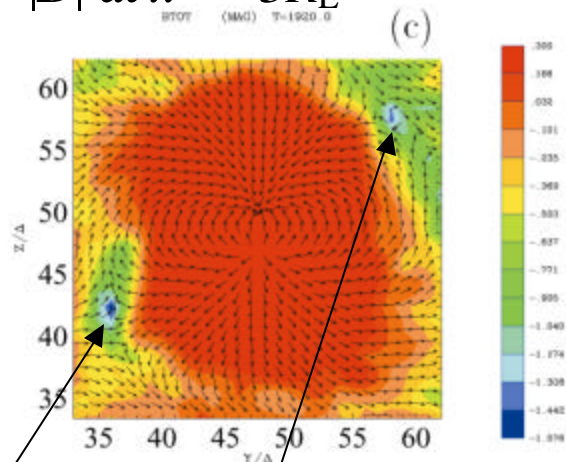
$|B|$ at $x = 3R_E$ *Sash*



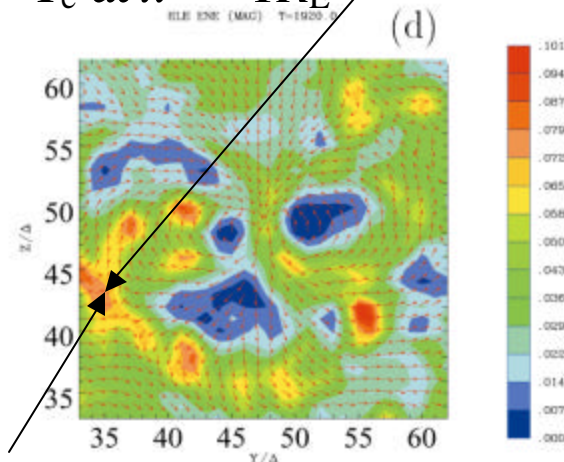
$|B|$ at $x = -1R_E$



$|B|$ at $x = -3R_E$



T_e at $x = -1R_E$ **Reconnection**

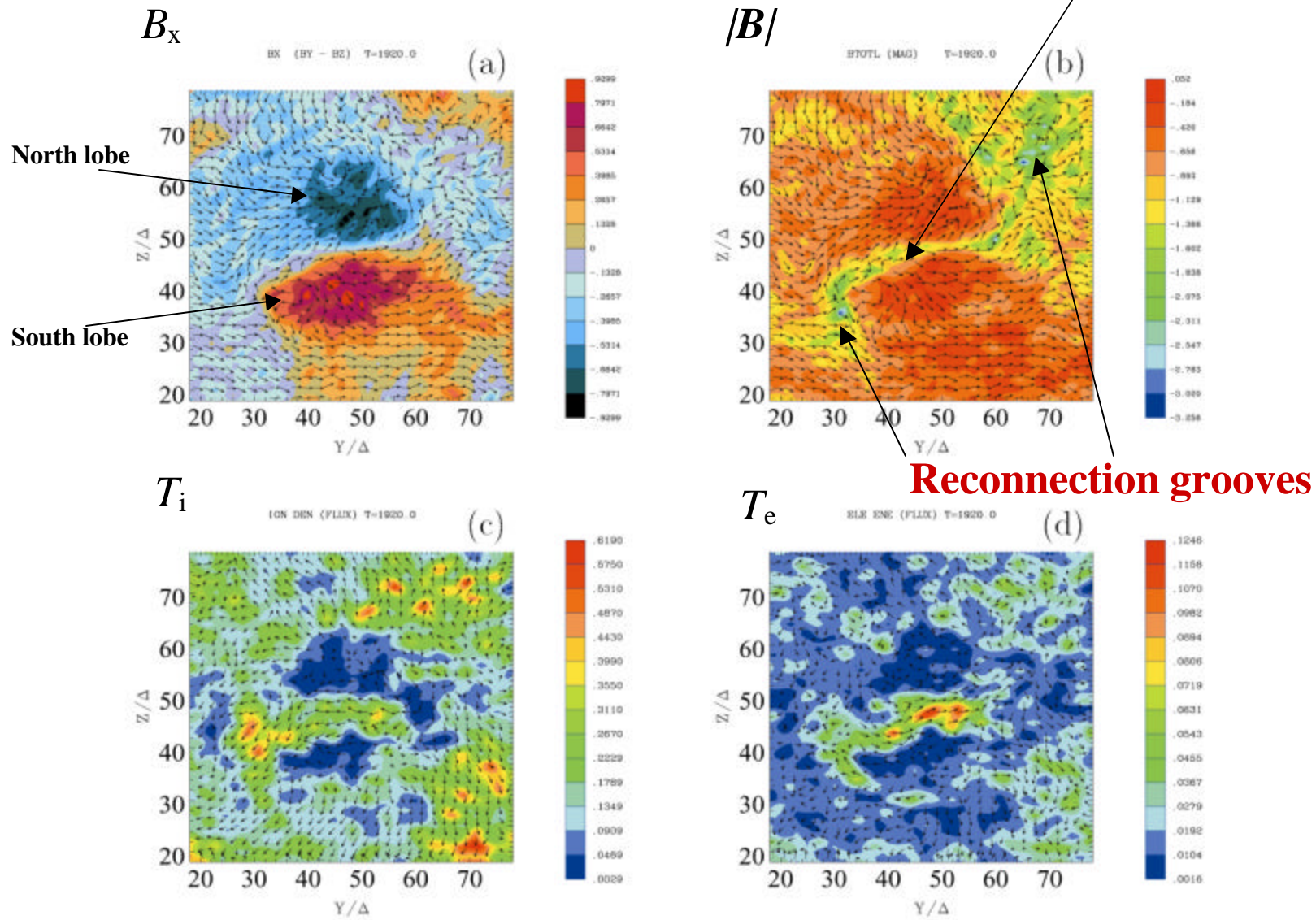


Reconnection

Particle injection and acceleration
Nishikawa, GRL 1998

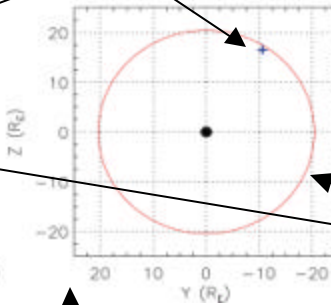
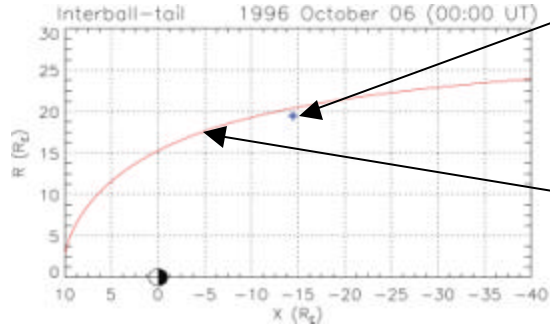
Dusk-dawn cross-section at $x = -15R_E$

Sigmoid shape

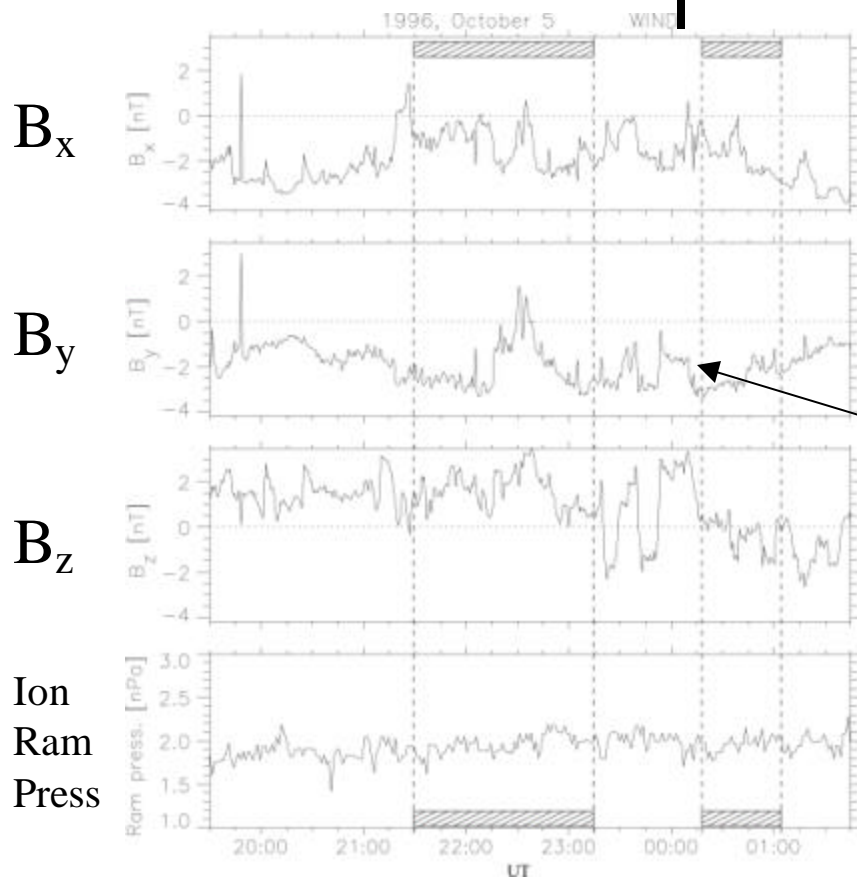


Nishikawa, GRL 1998

Interball-Tail (00:00UT)



Magnetopause
(Shue et al., 1997)



IMF components in GSM coordinates by Wind ($X_{\text{GSM}} = 9$, $Y_{\text{GSM}} = 9$, $Z_{\text{GSM}} = 9$).

The data are shifted in time in order to correspond to the Interball-Tail location.

Dawnward IMF

[Popescu et al., JGR, 2001]

electron

T_e

ion

N_i

T_i

V_x

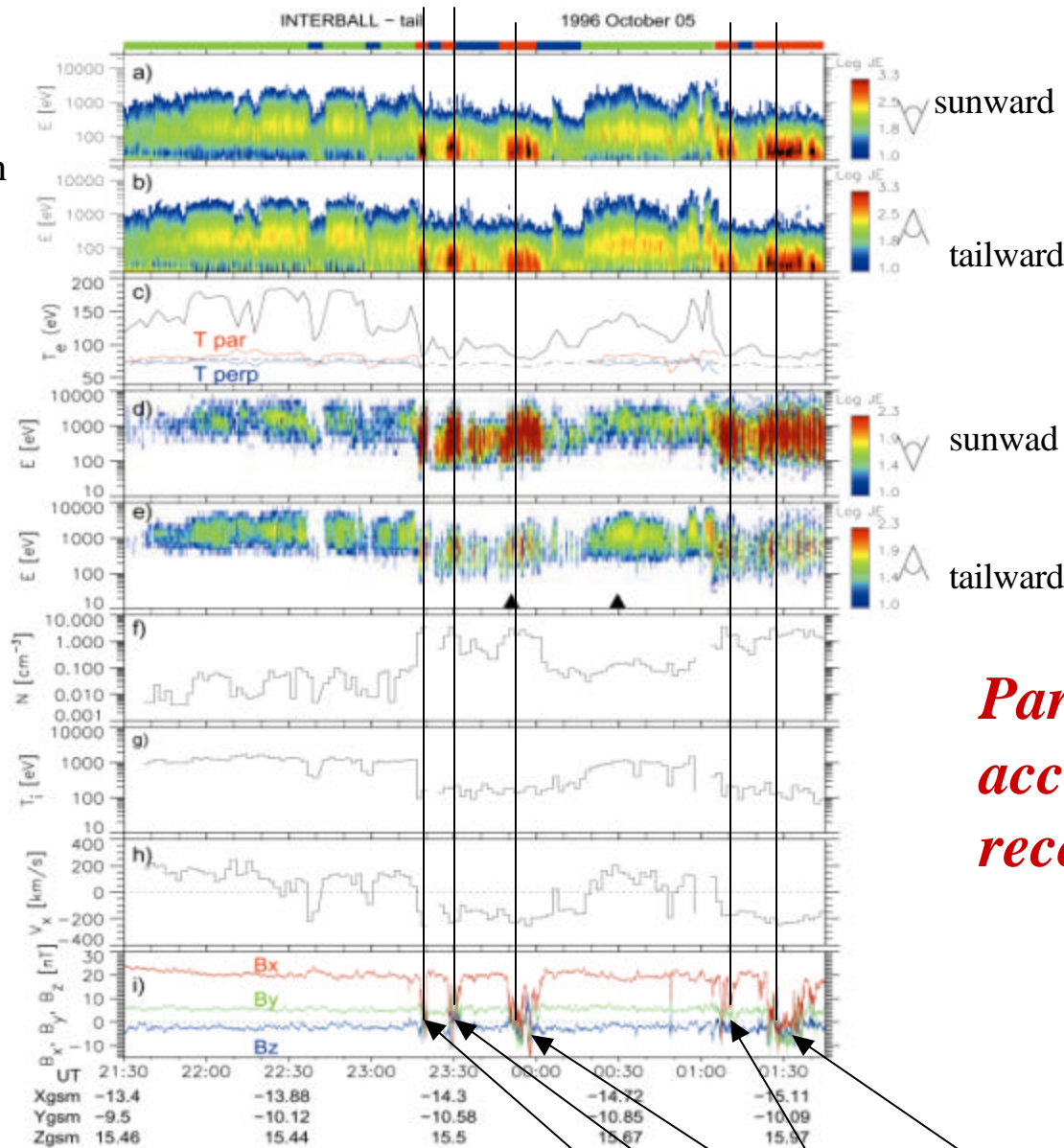


Figure 3

Particle and magnetic field measurements made on board Interball-Tal at the high latitude dawn northern lobe [Popescu et al. JGR, 2001]

Particle injection and acceleration through reconnection grooves?

Reconnection groove (Sash) (weak B_x)

“Sash” observed by Interball

* Magnetic variations \Rightarrow open magnetic field

* Origin of magnetic field minimum

IMF (reconnection)

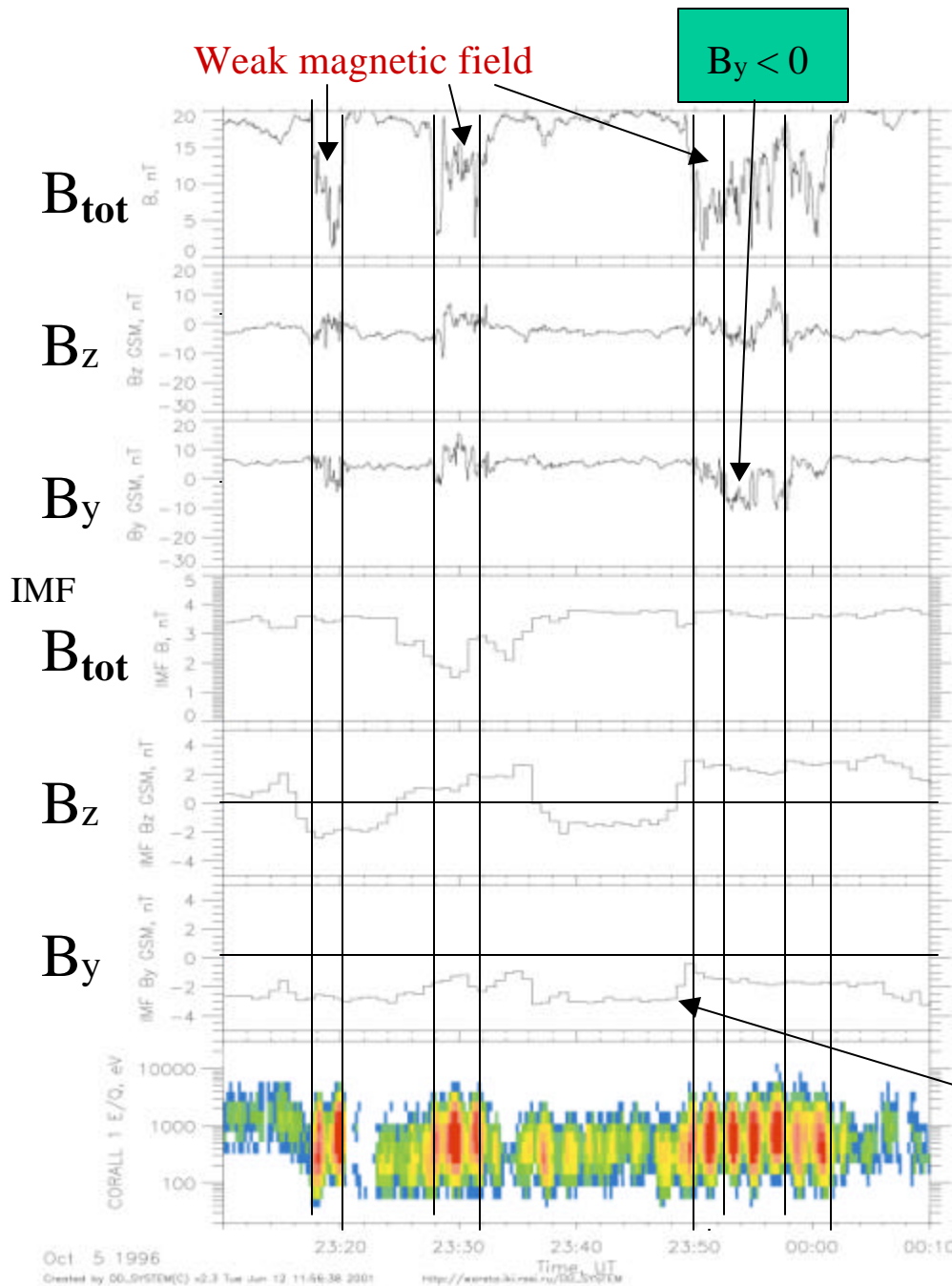
Diamagnetic effect produced by

magnetosheath plasma entry through
the open magnetic field

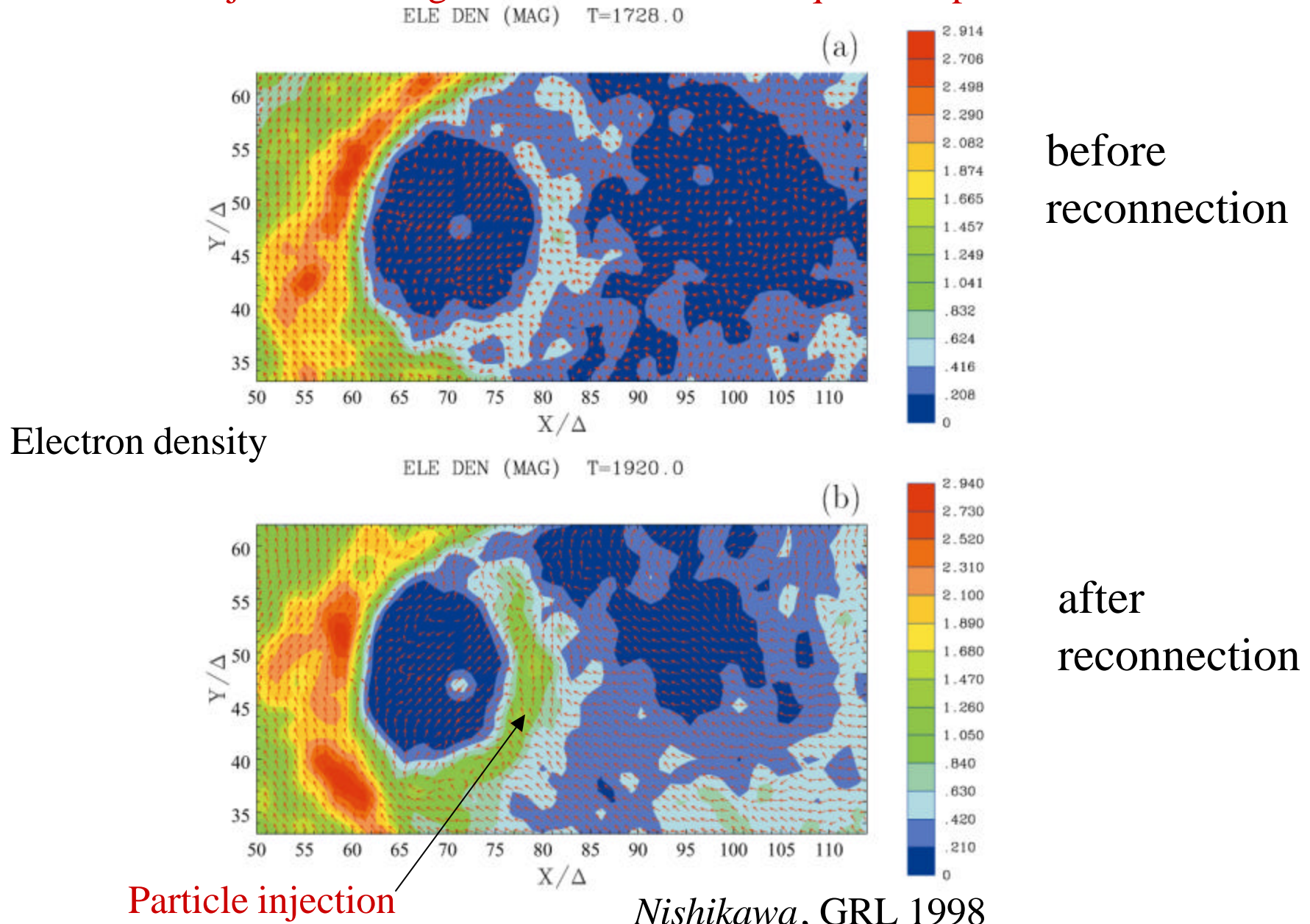
* Open field lines are created by the reconnection

Sash: place where the magnetosheath
plasma enters the magnetosphere
through the open magnetic field
due to the reconnection

Downward



Particle injection through reconnection at the equatorial plane



Future work

- Investigate the temporal and spatial evolution of dayside and nightside magnetopause (mantle) and associate **particle injection** in assistance of **Interball and Cluster-II observations with global particle simulations**
 - * at the dayside magnetopause reconnection in particular with **IMF B_y and B_x components**
 - * at the lobes ($< -15R_E$)
 - * effects of IMF orientations on particle injections
- Run **the new code with HPF** in order to obtain better resolutions with less noise levels, which will provide appropriate simulation results for **comparisons with Interball and Cluster observations and interpretations of physics**